

We claim:

1. An apparatus for a gateway to switch between a multi-channel streaming system for multiple-description and protection transmission and a multi-channel streaming system for scalable-video and protection transmission based on network channel conditions,

5 comprising:

a multi-channel streaming system for transmitting and receiving at least two coding formats

a. scalable-video and protection format of a prioritized encoded packet stream that has been further encoded by an FEC-MDC encoder;

10 b. multiple description and protection format of a prioritized encoded packet stream that has been further encoded by an FEC-MDC encoder; and

a mapping mechanism for mapping between the scalable-video and multiple-description format of a received multi-channel video stream such that video data coding and channel coding of the FEC-MDC encoded prioritized encoded packet stream is

15 preserved,

wherein, when a multi-channel packet stream is received by a gateway and network channel conditions indicate a change needs to be made in the format of the packet stream, the received stream is mapped by the mapping mechanism between the multiple-description format and the scalable-video format and then transmitted by the gateway using the multi-channel streaming system.

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2. The apparatus of claim 1, wherein the multi-channel streaming system further comprises a plurality of hinting tracks, each of said plurality of hinting tracks being associated with at least one of said at least two coding formats.

3. The apparatus of claim 1, wherein said multi-channel streaming system further comprises:

- a first multi-channel streaming system for transmitting and receiving a video stream
- 5 according to said scalable-video and protection format; and
- a second multi-channel streaming system for transmitting and receiving a video stream according to said multiple-description and protection format.

4. The apparatus of claim 3, wherein said first multi-channel streaming system further 10 comprises:

- a plurality of channels for transmission of a prioritized layer as a separate stream;
- at least once FEC channel for transmission of at least one separate stream comprising FEC codes, wherein an FEC packet may be discarded based on good network channel conditions; and
- 15 an Automatic Repeat reQuest channel for transmission of at least a most important video packet of said received video stream, wherein said ARQ channel is transmitted in a delayed fashion.

5. An apparatus for a source to encode a raw video stream for transmission and 20 transmit the encoded stream over a multi-channel streaming system based on network channel conditions, comprising:

- an encoder for encoding and prioritizing a raw video stream into n -partitions of progressively decreasing importance;
- an MD-FEC encoder that spread the n -partitions across a set of n -descriptions and

computes channel codes for the n -descriptions such that the n -partitions are protected by n -channel codes of decreasing strength;

a multi-channel streaming system for transmitting and receiving at least two coding formats

- a. scalable-video and protection format of a prioritized encoded packet stream that has been further encoded by an FEC-MDC encoder, and
- b. multiple description and protection of a prioritized encoded packet stream that has been further encoded by an FEC-MDC encoder; and

a mapping that maps the MD-FEC encoded n -descriptions to one of the at least two coding formats based on network channel conditions,

wherein said source employs said encoder to MD-FEC encode a prioritized video stream from a raw video stream, and based on network channel conditions employs said mapping to map the MD-FEC encoded stream to one of said at least two coding formats and employs said multi-channel streaming system to transmit said formatted stream over the network.

15 6. The apparatus of claim 5, wherein the multi-channel streaming system further comprises a plurality of hinting tracks, each of said plurality of hinting tracks being associated with at least one of said at least two coding formats.

20 7. The apparatus of claim 5, wherein said multi-channel streaming system further comprises:

a first multi-channel streaming system for said scalable-video and protection transmission and reception; and

a second multi-channel streaming system for said multiple-description and protection transmission and reception.

8. The apparatus of claim 7, wherein said first multi-channel streaming system further comprises:

5 a plurality of channels for concurrent transmission of a prioritized layer as a separate stream;

 at least once FEC channel for transmission of at least one separate stream comprising FEC codes, wherein an FEC packet may be discarded based on good network channel conditions; and

10 an Automatic Repeat reQuest channel for transmission of at least a most important video packet of said received video stream, wherein said ARQ channel is transmitted in a delayed fashion.

9. A network comprising:

15 at least one source node of at least one raw video stream, said at least one source node comprising an apparatus according to claim 5 for encoding and transmitting said at least one raw video stream over the network using said multi-channel streaming system; and

20 at least one gateway node comprising an apparatus according to claim 1, for receiving, mapping, and transmitting an MD-FEC encoded stream according to network conditions.

10. A network comprising:

 at least one source node of at least one raw video stream, said at least one source node comprising an apparatus according to claim 6 for encoding and transmitting said at least one raw video stream over the network using said multi-channel streaming system;

and

at least one gateway node comprising an apparatus according to claim 2, for receiving, mapping, and transmitting an MD-FEC encoded stream according to network conditions.

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11. A network comprising:

at least one source node of at least one raw video stream, said at least one source node comprising an apparatus according to claim 7 for encoding and transmitting said at least one raw video stream over the network using said multi-channel streaming system;

10 and

at least one gateway node comprising an apparatus according to claim 3, for receiving, mapping, and transmitting an MD-FEC encoded stream according to network conditions.

15 12. A network comprising:

at least one source node of at least one raw video stream, said at least one source node comprising an apparatus according to claim 8 for encoding and transmitting said at least one raw video stream over the network using said multi-channel streaming system;

and

20 at least one gateway node comprising an apparatus according to claim 4, for receiving, mapping, and transmitting an MD-FEC encoded stream according to network conditions.

13. A method for switching between a multi-channel streaming system for multiple-

description and protection transmission and a multi-channel streaming system for scalable-video and protection transmission based on network channel conditions, comprising the steps of:

providing a multi-channel streaming system having at least two coding formats

5 a. scalable-video and protection format of a prioritized encoded packet

stream that has been further encoded by an FEC-MDC encoder;

b. multiple description and protection format of a prioritized encoded packet stream that has been further encoded by an FEC-MDC encoder;

receiving a multi-channel packet stream formatted in accordance with one of said at

10 least two coding formats;

probing the network to obtain channel conditions;

in accordance with obtained channel conditions, mapping between the scalable-video and multiple-description format as determined by the format of the received multi-channel video stream such that video data coding and channel coding of the FEC-MDC
15 encoded prioritized encoded packet stream is preserved; and

retransmitting the mapped video stream with the provided multi-channel streaming system.

14. The method of claim 13, wherein the step of providing a multi-channel streaming system further comprises the step of providing a plurality of hinting tracks, each of said plurality of hinting tracks being associated with at least one of said at least two coding formats.

15. The method of claim 13, wherein the step of providing said multi-channel streaming

system further comprises the steps of:

providing a first multi-channel streaming system for transmitting and receiving a video stream according to said scalable-video and protection format; and

5 providing a second multi-channel streaming system for transmitting and receiving a video stream according to said multiple-description and protection format.

16. A method for encoding a raw video stream for transmission and transmitting the encoded stream by a source over a multi-channel streaming system based on network channel conditions, comprising the steps of:

10 encoding and prioritizing a raw video stream into n -partitions of progressively decreasing importance;

spreading the n -partitions across a set of n -descriptions and computing channel codes for the n -descriptions such that the n -partitions are prioritized and protected by n -channel codes of decreasing strength;

15 providing a multi-channel streaming system for transmitting and receiving at least two coding formats:

- a. scalable-video and protection format, and
- b. multiple description and protection format; and

20 mapping the n -descriptions to one of the at least two coding formats based on network channel conditions; and

transmitting the mapped n -description by the provided multi-channel streaming system.

17. The method of claim 16, wherein the step of providing the multi-channel streaming

system further comprises the step of providing a plurality of hinting tracks, each of said plurality of hinting tracks being associated with at least one of said at least two coding formats.

5 18. The method of claim 16, wherein the step of providing said multi-channel streaming system further comprises the steps of:

 providing a first multi-channel streaming system for said scalable-video and protection transmission and reception; and
 providing a second multi-channel streaming system for said multiple-description and protection transmission and reception.

10 19. A method for providing a network, comprising the steps of:
 providing at least one source node of at least one raw video stream;
 said at least one source node performing the method of claim 16 for encoding,
15 protecting and transmitting said at least one raw video stream over the network using said multi-channel streaming system;
 providing at least one gateway node; and
 said at least one gateway node performing the method of claim 13, for receiving,
 mapping, and retransmitting said encoded and protected video stream according to network
20 conditions.

20. A method for providing a network, comprising the steps of:
 providing at least one source node of at least one raw video stream;
 said at least one source node performing the method of claim 17 for encoding,

protecting and transmitting said at least one raw video stream over the network using said multi-channel streaming system;

providing at least one gateway node; and

5 said at least one gateway node performing the method of claim 13, for receiving, mapping, and retransmitting said encoded and protected video stream according to network conditions.

21. A method for providing a network, comprising the steps of:

providing at least one source node of at least one raw video stream;

10 said at least one source node performing the method of claim 18 for encoding, protecting and transmitting said at least one raw video stream over the network using said multi-channel streaming system;

providing at least one gateway node; and

15 said at least one gateway node performing the method of claim 13, for receiving, mapping, and retransmitting said encoded and protected video stream according to network conditions.

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